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**MORPHOLOGY AND MOLECULES IN LITHISTID TAXONOMY: NEW SOLUTIONS FOR OLD PROBLEMS.** *Memoirs of the Queensland Museum 44: 274. 1999*:- Most lithistid sponges lack an adequate range of taxonomic characters for differentiation, and in most genera these characters are extremely plastic. Consequently, the generation of morphological hypotheses in comparison with molecular phylogenies is nearly impossible due to the absence of reliable synapomorphies. Historically, lithistids have been grouped together in a single order on the basis of common possession of an interlocking siliceous skeleton. Recent morphological and palaeontological data indicate, however, that lithistid sponges are polyphyletic; several genera possess skeletal characters that suggest affinity with non-lithistid demosponges. We have found that in many cases these characters are probably non-homologous and misleading.

Ongoing research on the phylogeny of lithistid sponges has revealed some interesting 'anomalies' of identification. Although our data collection is still incomplete, we have already found unexpected phylogenetic affinities between three lithistid species in Theonellidae and Corallistidae, comparing morphological and 28S rDNA analyses. Surprisingly, the nearest relatives of de Laubenfel's (1954) '*Plakinalopha*' *mirabilis* are *Theonella* spp.; *Theonella atlantica* is more closely related to *Corallistes* spp. than to *Theonella* spp.; and *Theonella tubulata* Van Soest is more closely related to *Macandrewia azorica* (in the Corallistidae) than to other *Theonella*.

What is to be done in this situation ? To what extent can molecular hypotheses be accepted over morphological hypotheses or vice versa ? We have found that rather than having to 'accept' one over the other, which often goes against 'instinctual phylogeny', molecular data makes us re-examine these problems by reciprocal illumination, through the generation of higher quality morphological research and the examination of characters that are often, not at first, obvious. With this group of lithistid sponges, triaene rhabd and clade morphology, microsclere ornamentation, and the patterns of desma zygoses, and shaft ornamentation become crucially important in differentiating taxa.

Thus, for this particular group of organisms, we have found that morphological hypotheses between closely related taxa are often strongly informative and can lend crucial evidence for the acceptance of certain molecular phylogenies over others. Molecular data can clearly indicate relationships between organisms where morphological data had previously failed, and molecular data often require us to re-examine morphological characters from new perspectives, leading the discovery of new taxonomic discriminators. ❐ *Porifera, phylogeny, 28S rDNA, morphology, congruence, lithistid, Theonellidae, Corallistidae.*

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